SEVERAL MATERIALS USED IN THE PREPARATION OF COMMERCIAL CIGARETTES

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OBJECTIVES

The process of smoking tobacco involves several complex mechanisms [1]. Moreover, it is well known that the composition of the commercial cigarettes include several additives in order to modify several structural or organoleptic properties, and there is a general agreement in the importance of study the individual behaviour of the different cigarette ingredients in the smoking process [2,3]. Thus, in this work, the pyrolysis of reference tobacco and three substances widely employed as cigarette ingredients as well as the corresponding mixtures has been studied by thermogravimetric analysis.

Ingredients.

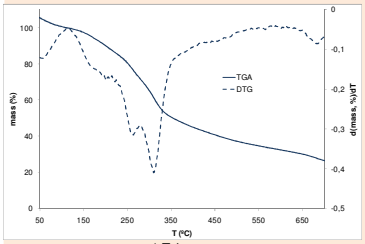
a) Tobacco: *3R4F cigarettes* from "*Reference Cigarette Program of the College of Agriculture of the University of Kentucky*".

b) Aditives: *glycerol* and *D-sorbitol* provided by Sigma Aldrich and *D(+)-sucrose*, from AnalaR NORMAPUR (D (+)-sucrose).

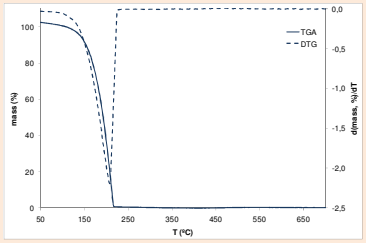
THERMOGRAVIMETRIC ANALYSIS

7 mg of sample (pure ingredients and mixtures) were pyrolyzed in a Netzsch TG 209 thermobalance, using an Al_2O_3 crucible which was introduced into the furnace of the device. The temperature of the sample was measured with a thermocouple placed in a position very close to the crucible. Samples were heated at 10ºC/min from 30° C to 750° C. 30 mL/min (STP) of N_2 were used as carrier gas in order to ensure an inert atmosphere. The reference tobacco was ground with an agate mortar to avoid the heterogeneity associated with the existence of different varieties of tobacco and fibers of different size and shape. Mixtures of the different ingredients were homogenized thororughly, after weighing the ingredients directly in the crucible.

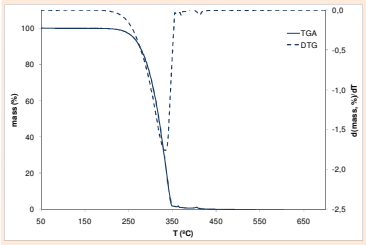
RESULTS



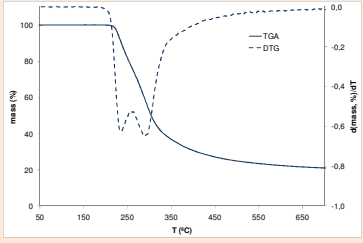
a) Tobacco



b) Glycerol



c) Sorbitol



d) Saccharose

Pyrolysis of pure ingredients

Tobacco: 6 stages of decomposition can be observed:

- Evaporation of water (humidity loss) below 110 °C.
- Evaporation of other volatile compounds (including glycerol) between 110 and 220 ℃
- Main weight loss in two stages between 220 and 365 (attributed, respectively to the decomposition of hemicellulose and pectin at around 260ºC and cellulose at around 310ºC
- Decomposition of lignin at devolatilization of char at around 467ºC

Glycerol and Sorbitol: both additives evolve through a single decomposition step, at a temperature below the normal boiling point in the case of glycerol, and higher in the case of sorbitol

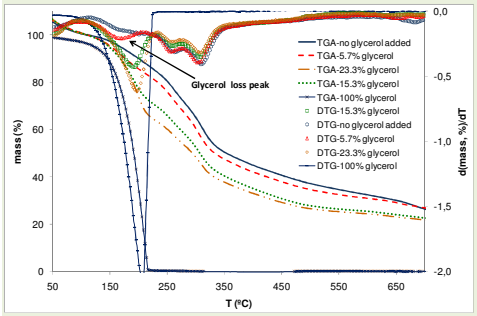
Saccharose: two decomposition stages, partially overlapped, with DTG peaks at 237ºC and 291ºC.

Pyrolysis of tobacco-additive binary mixtures

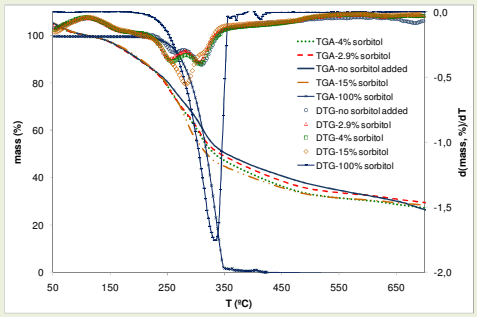
Tobacco-Glycerol: the more the concentration of glycerol, the more the weight loss between 110-220º C. Displacement of this step towards lower temperatures as the glycerol content in the mixture decreases

Tobacco-Sorbitol: the pyrolysis of tobacco is not noticeably affected by the addition of sorbitol, but the weigh loss of sorbitol is clearly modified in the presence of tobacco, being displaced towards lower temperatures

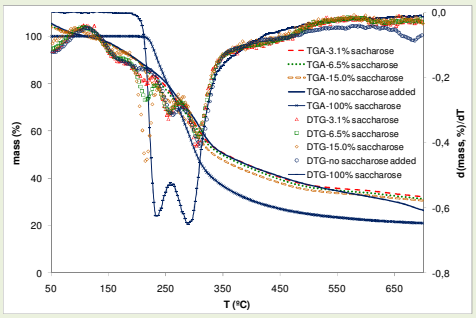
Tobacco-Saccharose: clear interaction between the pyrolysis of both materials resulting in a decrease in decomposition temperature of the decomposition of the sugar.



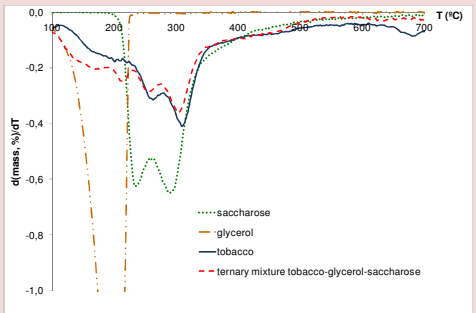
a) Tobacco + glycerol



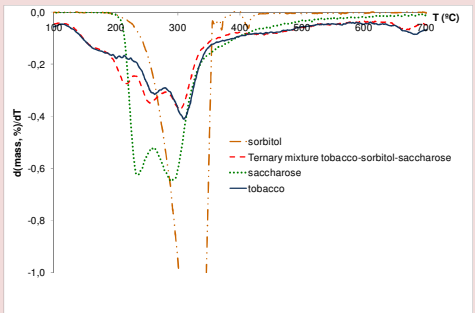
b) Tobacco + sorbitol



b) Tobacco + saccharose



a) Tobacco + 7.2% glycerol + 5.6% saccharose



a) Tobacco + 2.8% sorbitol + 6.4% saccharose

Pyrolysis of tobacco-additive ternary mixtures

- Increase of the tobacco-peak in the range 110-220ºC and a slight displacement towards lower temperatures as a consequence of the presence of glycerol. This peak is not modified in the presence of sorbitol.
- The peak related with the presence of sorbitol is overlapped with the tobacco DTG-peaks
- A noticeable decrease of the tobacco peak at around 650ºC as a consequence of the presence of both additives, humectant and saccharose.
- The appearance of a peak at around 210ºC as a consequence of the presence of saccharose.

CONCLUSIONS

TGA reflects the existence of six stages of decomposition in the thermal pyrolysis of tobacco. Weight loss for glycerine and sorbitol is produced in a single step at 211ºC and 362ºC, respectively, and pyrolysis of saccharose involves two decomposition steps. The pyrolysis of the mixtures of tobacco and the ingredients studied in this work reveals the existence of some interaction which results in changes in the relative importance and in the temperature of the different reaction steps. This results highlight the importance of to carry out studies of the individual behaviour of the ingredients used in the fabrication of cigarettes as well as studies focused in the possible interactions tobacco-ingredient.

REFERENCES

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